

<b>Physics</b>	<b>Group-I</b>	<b>Paper-II</b>
<b>Time: 1.45 Hours</b>	<b>(Subjective Type)</b>	<b>Max. Marks: 48</b>

## (Part-I)

### **2. Write short answers to any Five (5) questions: (10)**

**(i) Write down two characteristics of simple harmonic motion.**

**Ans** Two characteristics of simple harmonic motion are:

1. A body executing simple harmonic motion always vibrates about a fixed position.
2. Its acceleration is always directed towards the mean position.

**(ii) Prove that:  $v = f\lambda$**

**Ans** The velocity of wave is defined as:

$$\text{Velocity} = \frac{\text{distance}}{\text{time}}$$

$$v = \frac{d}{t}$$

If time taken by the wave in moving from one point to another is equal to its time period  $T$ , then the distance covered by the wave will be equal to one wavelength, hence we can write

$$v = \frac{\lambda}{T}$$

But time period  $T$ , is reciprocal of the frequency  $f$ , i.e.,  $T = \frac{1}{f}$

Hence proved

$$v = f\lambda$$

**(iii) What do you know about Ripple Tank?**

**Ans** Ripple tank is a device to produce water waves and to study their characteristics.

This apparatus consists of a rectangular tray having glass bottom and is placed nearly half meter above the surface of a table.

**(iv) What is tuning fork?**

**Ans** A two-pronged steel device used by musicians, which vibrates when struck to give a note of specific pitch.

**(v) Write two uses of ultrasound in medical field.**

**Ans** Two uses of ultrasound are:

1. Powerful ultrasound is now being used to remove blood clots formed in arteries.
2. It can also be used to get pictures of thyroid gland for diagnosis purposes.

**(vi) State Lenz's Law.**

**Ans** Lenz's law:

The direction of an induced current in a circuit is always such that it opposes the cause that produces it.

**(vii) What is difference between step-up and step-down transformer?**

**Ans** If the secondary voltage is larger than the primary voltage, the transformer is called a step-up transformer.

If the secondary voltage is smaller than the primary voltage, that is called step-down transformer.

**(viii) What is the function of relay?**

**Ans** Relays are switches that open and close circuits electromechanically or electronically. Relays control one electrical circuit by opening and closing the contacts in another circuit.

**3. Write short answers to any FIVE (5) questions: (10)**

(i) Define power of lens and write its unit.

**Ans** "The reciprocal of focal length of a lens in metres is known as power of lens."

**Unit:**

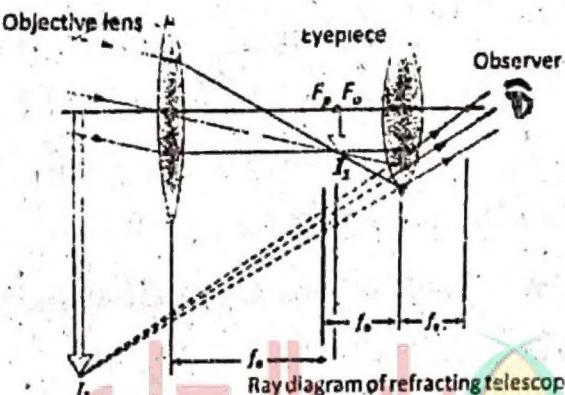
SI unit of power of a lens is Dioptre. It is denoted by D.

**Dioptre:**

It is power of lens whose focal length is one metre.

(ii) Draw the ray diagram of refracting telescope.

**Ans**



(iii) How can you define optical fibre?

**Ans** An optical fibre is made by a highly transparent fine strand of glass or plastic coated or cladded with another type of glass whose refractive index is less than the inner tube.

(iv) What is meant by compact disc?

**Ans** A molded plastic disc containing digital data that is scanned by a laser beam for the reproduction of recorded sound or other information is called compact disc.

(v) Define telecommunication.

**Ans** "The method that is used to communicate information to far-off places instantly is called telecommunication."

(vi) Define piracy and floppy disc.

**Ans** Piracy:

The illegal duplication of copyrights materials like books, papers and software etc. is called piracy.

**Floppy disc:**

A floppy disc is a small magnetically sensitive, flexible plastic wafer housed in a plastic case. It is inexpensive, convenient and reliable storage device.

(vii) What do you mean by background radiations?

**Ans** Radiations present in the atmosphere is due to the different radioactive substances are called background radiations. Everywhere in rocks, soil, water and air of our planet are traces of radioactive elements. This natural radiation is called background radiation.

(viii) Write down two uses of radioisotopes.

**Ans** The two uses of radioisotopes are:

1. Radioisotopes are used in nuclear medicines for curing various diseases. For example, radioactive cobalt-60 is used for curing cancerous tumors and cells.
2. Radioactive carbon-14 is present in small amount in the atmosphere. Live plants use carbon dioxide and, therefore, become slightly radioactive.

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**4. Write short answers to any Five (5) questions: (10)**

(i) Describe the construction of electroscope.

**Ans** Electroscope consists of a brass rod with a brass disk at the top and two thin leaves of gold foil hanging of the bottom. The rod passes through an insulator that keep the rod in place. Charges can move freely from the disk to the leaves through the rod. A thin aluminium foil is attached on the lower position of the inside of the jar.

Usually, the aluminium foil is grounded by connecting a copper wire. This protects the leaves from the external electrical disturbances.

- (ii) Differentiate between ohmic and non-ohmic material.

**Ans** Materials that obey's Ohm's law, and hence a constant resistance over a wide range of voltages, are said to be ohmic. Materials having resistances that changes with voltage or current are non-ohmic.

- (iii) Define the S.I unit of capacitance of a capacitor.

**Ans** "If one coulomb of charge given to the plates of a capacitor produces a potential difference of one volt between the plates of the capacitor then its capacitance would be one Farad."

S.I unit of capacitance is Farad (F).

- (iv) What is the difference between conductors and insulators?

**Ans** The substances which allow electric current to pass through them are called **conductors**. For example, metals like iron, copper, silver, etc.

The substances through which electric current cannot flow through them are called **insulators**. For example, glass, wood, plastic, fur, etc.

- (v) Define specific resistance of a substance. Also write its S.I unit.

**Ans** The specific resistance or resistivity may be defined as "the total resistance between opposite faces of two end of that materials."

The S.I unit of specific resistance is ohm-meter ( $\Omega\text{m}$ ).

(vi) For which purpose circuit breaker is used in circuits?

**Ans** The circuit breaker is used in circuit as a safety device in the same way as a fuse.

(vii) Describe the function of deflecting plates in cathode ray oscilloscope.

**Ans** After leaving the electron gun, the electron beam passes between a pair of horizontal plates. A potential difference applied between these plates deflects the beam in a vertical plane. This pair of plates provides the y-axis or vertical movement of the spot on the screen. A pair of vertical plates provides the x-axis or horizontal movement of the spot on the screen.

(viii) Describe the uses of cathode ray oscilloscope.

**Ans** Cathode-ray oscilloscopes are used:

1. Displaying waveforms.
2. Range-finding (as in radar).
3. To find the depth of seabed (Echo-sounding).
4. It also used to display heartbeats.

### (Part-II)

**NOTE: Attempt any Two (2) questions.**

**Q.5.(a) State the reflection of light and explain laws of reflection. (4)**

**Ans** **Reflection of Light:**

Reflection of light is illustrated in the following Fig. When a ray of light from air along the path AO falls on a plane mirror M, it is reflected along the path OB. The ray AO is called incident ray while the ray OB is called reflected ray. The angle between incident ray AO and normal N, i.e.,  $\angle AON$  is called the angle of incidence

represented by  $i$ . The angle between the normal and the reflected ray OB, i.e.,  $\angle NOB$  is called angle of reflection represented by  $r$ .

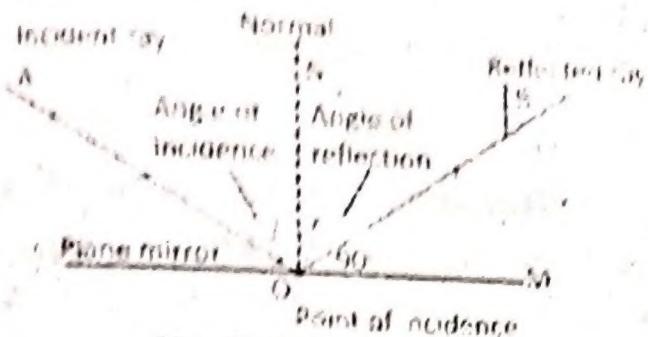


Fig. Reflection of light.

So phenomenon of Reflection is:

When light travelling in a certain medium falls on the surface of another medium, a part of it turns back in the same medium.

#### Laws of Reflection:

- (i) The incident ray, the normal, and the reflected ray at the point of incidence all lie in the same plane.
  - (ii) The angle of incidence is equal to the angle of reflection i.e.,  $i = r$ .
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- (b) A doctor counts 72 heartbeats in one minute. Calculate the frequency and period of the heartbeats. (5)

Ans

Given Data:

Number of counts  $n = 72$

Time  $t = 1 \text{ min.} = 60 \text{ sec}$

$$f = \frac{\text{number of beats}}{\text{time}}$$

Putting values, we get

$$f = \frac{72}{60} = 1.2 \text{ Hz}$$

And  $fT = 1$

$$T = \frac{1}{f}$$

$$T = \frac{1}{1.2} = 0.83 \text{ sec}$$

**Q.6.(a) Explain parallel combination of resistors with the help of circuit diagram.** (4)

**Ans** For Answer see Paper 2017 (Group-I), Q.6.(a).

**(b) Two point charges  $q_1 = 10 \mu\text{C}$  and  $q_2 = 5 \mu\text{C}$  are placed at a distance of 150 cm. What will be the Coulomb's force between them? Also find the direction of the force.** (5)

**Ans** Given data:

Let charges are  $q_1 = 10 \mu\text{C}$

$$q_1 = 10 \times 10^{-6}\text{C}$$

$$q_2 = 5 \mu\text{C} \quad q_2 = 5 \times 10^{-6}\text{C}$$

Placed at distance  $r = 150 \text{ cm} \quad r = 1.50 \text{ m}$

And in S.I units:

$$1 \mu\text{C} = 10^{-6}\text{C}$$

$$1 \text{ m} = 100 \text{ cm}$$

$$k = 9 \times 10^9 \text{ Nm}^2\text{C}^{-2}$$

Coulomb's law,

$$F = k \frac{q_1 q_2}{r^2}$$

By putting values, we get

$$F = (9 \times 10^9) \frac{10^{-5} \times 5 \times 10^{-5}}{(1.5)^2}$$

$$F = \frac{9 \times 5 \times 10^{9-10}}{2.25} = \frac{4.5}{2.25}$$

$$F = 2 \text{ N}$$

The changes are same, so there will be repulsion between the charges.

**Q.7.(a) What is electron gun? Explain the process of thermionic emission.** (4)

**Ans** Electron Gun:

The electron gun consists of an electron source which is an electrically-heated cathode that ejects electrons. Electron gun also has an electrode called grid G for controlling the flow of electrons in the beam. The grid is connected to a negative potential. The more negative this potential, the more electrons will be repelled from the grid and hence fewer electrons will reach the anode and the screen. The number of electrons reaching the screen determines the brightness of the screen. Hence, the negative potential of the grid can be used as a brightness control. The anode is connected to positive potential and hence is used to accelerate the electrons. The electrons are focused into a fine beam as they pass through the anode.

### **Thermionic Emission:**

The process of emission of electrons from the hot metal surfaces is called thermionic emission. Metals contain a large number of free electrons. At room temperature, electrons cannot escape the metal surface due to attractive forces of the atomic nucleus. If the metal is heated to a high temperature, some of the free electrons may gain sufficient energy to escape the metal surface.

Thermionic emission can also be produced by electrically heating a fine tungsten filament. Typical values of the voltage and current used are 6 V and 0.3 A, respectively.

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- (b) Half-life of a radioactive element is 10 minutes. If the initial count rate is 368 counts per minute, find the time by which count rate reaches 23 count per minute? (5)

**Ans** Let,

$$\text{Half-life of a radioactive element} = T_{1/2} = 10 \text{ mins}$$

The original activity =  $A_0 = 368$  counts per minute

As after first half-life time  $T_{1/2} = 10$  min

The activity will become  $A_0/2 = \frac{368}{2} = 184$  counts per minute

As after second half-life time  $2 \times T_{1/2} = 2 \times 10 = 20$  min

The activity will become  $A_0/4 = \frac{368}{4} = 92$  counts per minute

As after third half-life time  $3 \times T_{1/2} = 3 \times 10 = 30$  min

The activity will become  $A_0/8 = \frac{368}{8} = 46$  counts per minute

As after fourth half-life time  $4 \times T_{1/2} = 4 \times 10 = 40$  min

The activity will become  $A_0/16 = \frac{368}{16} = 23$  counts per minute.

Hence after 40 minutes its count rate will be 23 counts per minute.

